

wide inter-individual variability in the dose requirement. Beside non-genetic factors, polymorphisms in *VKORC1*, *CYP2C9* and *CYP4F2* genes have been shown to affect warfarin dosing in adults. The aim of the study was to determine the relative contribution of non-genetic and genetic factors to warfarin dose requirements in children and to evaluate the potential influence of these factors on the anticoagulation quality control.

Methods: Consecutive children were prospectively enrolled if they received long term warfarin therapy. By multivariate analyses, we assessed the influence of genetic (*CYP2C9*, *VKORC1* and *CYP4F2*) and non-genetic factors on the warfarin dose requirements and on the time spent within, above, and below the INR range.

Results: 83 children receiving warfarin (median age 9.0 years) with a weekly maintenance dose of 23.2 ± 15.0 mg (3.5 mg-84 mg), i.e. 0.93 ± 0.55 mg/kg, were included. All patients had cardiac diseases. Height, INR ranges, *VKORC1* and *CYP2C9* genotypes were retained in the final regression model, explaining 69.7% of the overall inter-individual variability in warfarin doses. In 86.7% of the patients, the difference between the observed dose and the dose predicted by the model was 1mg/day. The dose was overestimated in 8% of the patients and underestimated in 5.3%. Of the whole cohort, 61 children had INR values collected during the study period: the time spent within, above or below the therapeutic INR range was $83.0 \pm 14.6\%$, $9.0 \pm 10.5\%$, and $7.1 \pm 8.9\%$, respectively. No covariates were found associated with the anticoagulation quality.

Conclusion: Height, INR range, *VKORC1/CYP2C9* genotypes were the main contributors of warfarin dose requirement, explaining more than 2/3 of the variability. Genotyping in children requiring VKA treatment might be of interest to optimize dosing of warfarin and follow-up.

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Scimitar syndrome: a series of 90 consecutive patients from a single centre with a focus on associated pulmonary hypertension

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Background: Scimitar syndrome (Scim.) is a rare association of congenital cardiopulmonary anomalies with anomalous drainage of one or more of the right pulmonary veins to the inferior caval vein. Pulmonary hypertension (PH) is a common finding but its causes are poorly understood.

Objective: To analyse in a large series of Scim. the constellation of anatomic anomalies and their potential relation with PH and outcome.

Methods: From 1985 to 2010, we reviewed 90 consecutive cases of Scim for presenting symptoms, cardiac phenotype, extracardiac anomalies, surgical procedures and outcome. We also reviewed right heart catheterisation (RHC) for pulmonary hypertension (PH) when it had been performed.

Results: We identified 90 cases (53 females, 37 males) with Scim. Diagnosis was done in fetus in 10 pts, at birth in 25 pts, before 1 year of age in 34 pts, and after 1 year of age in 21 pts. 48/90 had an associated cardiac defect. The abnormal pulmonary venous return of the right lung was complete in 65 pts. Associated anomalies of systemic veins were present in 13 pts. Congenital stenosis of the scimitar vein was found in 10 pts and aberrant drainage in 2 pts. Systemic arterial supply to the right lung was present in 75 and considered significant in 60 pts. Extracardiac malformations were present in 21 pts including 7 diaphragmatic defects and 9 vertebral anomalies. 73 RHC had been performed (the remaining 17 pts had normal estimation of pulmonary pressures on echo): 51 pts had PH at time of diagnosis; PH had different causes that were frequently associated: PPHN in 17 neonates, PH due to massive overflow by the systemic supply in 10 pts; PH due to associated CHD in 7; postcapillary PH in 4; respiratory disease in 3; and finally, pulmonary arterial hypertension was observed in 26 pts with or without associated CHD. There were 24 deaths (18 neonates) that were directly related to refractory PH/ cardiac failure in 9 pts, and to severe respiratory disease in 4.

Conclusion: Mortality was high in our series and beside associated CHD, the management of PH of multifactorial origin is a remaining challenge.

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Characteristics of patients with pulmonary arterial hypertension associated with congenital heart disease in the registry of the French PAH network

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Epidemiological data relative to pulmonary arterial hypertension (PAH) associated with congenital heart disease (CHD) are scarce

Objective: To analyze PAH associated with CHD in patients enrolled in the second prospective PAH registry that was initiated by the French PAH network in November 2006.

Methods: PAH-related clinical and outcome data were analyzed from the registry. History and characteristics of CHDs were reviewed from the patients' files by cardiopediatricians.

Patients and results: 3987 patients with pulmonary hypertension were enrolled in 26 PAH centers, of whom 2585 had PAH. CHD-PAH (n=255) accounted for 9.8% of PAH, including 95 isolated pre-tricuspid shunts (mainly ASD), 134 isolated post-tricuspid shunts (mainly VSD), 11 combined pre- and post-tricuspid shunts and 15 complex CHD. 60% of pts were females. Mean age at study entry was 37 years, with 51 pts <18 years of age and 39 >60 years of age. With regards to age at diagnosis of CHD, 2 peaks were observed: <1 year (mainly diagnosis of VSD) and 30-50 years (mainly diagnosis of ASD). 23 pts had undergone palliative surgery, and 60 corrective procedures. The diagnosis of PAH was done with the diagnosis of CHD in 37% of the cases (mainly ASD and PDA) and in 60% PAH appeared during the follow-up of the CHD: in 10 pts the diagnosis of CHD was done after the diagnosis of PAH. PAH-specific characteristics at study entry were: 52% NYHA III-IV functional class (FC), 6MWD 370 ± 105 m, mPAP 59 ± 20 mmHg, cardiac index 2.7 ± 1.1 L/min/m², PVR 12.5 ± 10.3 WU at right heart catheterization (n=210). 47.1% of NYHA II pts and 42.8% of NYHA III pts were not receiving PAH-specific therapies. In treated pts (n = 164), NYHA FC improved (59% in NYHA FC I-II at last follow-up). During the 3-year follow-up period, 20 pts died (mainly of sudden death and right heart failure) and 7 pts were transplanted.

Conclusions: PAH is a complication of a previously known CHD in 60% of cases. ASD is the main CHD that is diagnosed concomitantly or after PAH. RHC is not performed systematically in CHD-PAH pts. Less than a half of NYHA III pts are offered PAH-specific therapies. Mortality was low during the short period of follow-up.

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Morphological analysis of Ebstein's anomaly: contribution of three-dimensional echocardiography

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Background: Assessing the exact morphology of tricuspid valve (TV) remains a major challenge in case of Ebstein's malformation. As the delamination failure may involve one or more leaflets of the TV, this anomaly is characterized by a great variability of its anatomy and function. Three-dimensional echocardiography (3DE) seems to be interesting to depict accurately the leaflets, the commissures and the orifice of the TV.

Objectives: To assess the feasibility and the efficiency of 3DE to appreciate the anatomy of the TV in case of Ebstein's anomaly. Patients and methods: It was a monocentric prospective study. 14 consecutive children (< 18 years) with a 2DE diagnosis of Ebstein's malformation were included. X-plane mode, 3D live and full-volume acquisitions were performed. Multiplanar review mode was used during the off-line analysis.

Results: Median age was 3.1 years (IQR, 0.4-9.9). Feasibility of the complete 3D analysis was 93% (13/14). Median time of the off-line analysis was 12.3 minutes (IQR, 9.3-15.2). According to 3DE, the diagnosis of tricuspid dysplasia was stated for 3 patients. 3DE allowed a good visualization of the